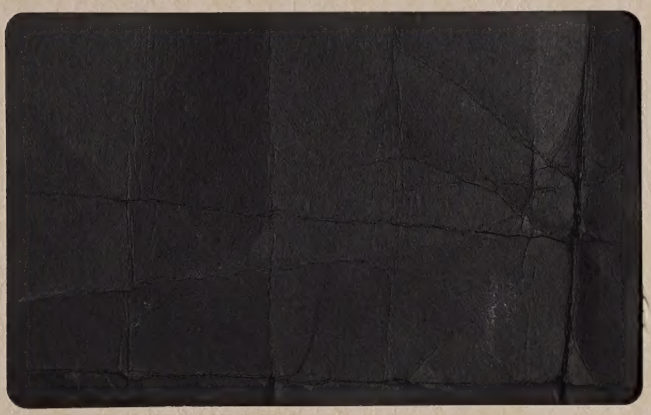
PULSE INSTRUMENTS COMPANY



GE Compton 1985

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APPLICATION		REVISION			
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PULSE INSTRUMENTS COMPANY

USER'S REFERENCE MANUAL

MODEL PI-110

DUAL CHANNEL PERIOD MULTIPLIER

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I. GENERAL DESCRIPTION

The PI-110 programmable, dual channel period multiplier is a plug-in unit designed to operate in the Tektronix TM-500 series power modules. It is compatible with other Pulse Instruments and Tektronix TM-500 series plug-ins operating in standard (non-custom wired) power modules.*

It is basically a count down device or frequency divider. However, the designation of period multiplication instead of frequency division is used in order to obtain more convenient to read integral time units rather than fractional frequency units.

The PI-110 has three clock output channels: A continuous or burst clock source output channel and two multiplied clock output channels. The clock source can be generated internally from a variable period oscillator, a crystal reference (option 001) or the AC line, or it can be applied externally.

The ratio of the multiplied clock period to that of the clock source can be selected to be any integer between 2 and 999 using the three digit front panel switch or by remote programming. In the cascaded mode, A x B, this ratio can be increased to 998,001 maximum. Furthermore, each multiplied clock output can be delayed from 50ns to 50us with respect to the clock source output, and its pulse width is adjustable from 50ns to 50us.

In the burst mode, the integer N_A loaded into channel A determines the exact number of clock pulses in the burst, and the integer N_B loaded into channel B determines the total clock periods in a burst cycle. The ratio N_A/N_B (where $N_A < N_B$) is, therefore, the burst duty factor. Channel A output is a negative going gate for the duration of the burst, and channel B output remains the multiplied clock output. A front panel switch is provided for the selection of continuous or single burst operation.

The PI-110 is a versatile signal source which can be used as a sync generator, variable time mark generator, programmable clock generator, counted burst generator, three-frequency pulse generator as well as the period multiplier or frequency divider.

* Do not force plug-in unit into non-compatible custom wired power modules (identified by non-matching barriers on edge connector inside power modules).

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CAUTION

Turn the power module off before inserting the plug-in unit; otherwise, damage may occur to the plug-in circuitry.

II. SPECIFICATIONS

CLOCK SOURCE

Int. Clock	Period variable from ≤ 50ns to > 50us in three decade steps, plus 10 to 1 continuously variable control. Width duty factor approximately 50%. Period jitter less than 0. % of setting +50ps.
XTAL REF (option 001 only)	10 or 20 MHz crystal reference, ±0.1%.
Line	60Hz
Ext. Clock	TTL compatible, 2V, 25ns pulse width min. single pulse to 20MHz.
Burst Clock	2 to 998 max. counted burst, 10MHz max. clock rate. Single or continuous.

MULTIPLIER

Normal	$2 \leq N \leq 999$, front panel control or remote programming,* ch A or B.
A x B	$4 \leq N_A \times N_B \leq 998{,}001$, ch B only. $2 \leq N_A \leq 999$, ch A.
Burst	N_A = No. of clock pulses in burst. N_B = No. of clock periods in a burst cycle, $N_B > N_A$. Clcok/Burst out: Burst Channel A output: Gate, delay and width controls inoperative.. Channel B output: Multiplied output with normal delay and width controls. "N" must be loaded at clock rates ≤10MHz.

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"A" and "B" Delays	≤50ns to > 50us in three decade steps, plus 10 to 1 continuously variable control delay jitter 0.1% of setting +50ps.
"A" and "B" Widths	≤50ns to > 50us in three decade steps, plus 10 to 1 continuously variable control width jitter 0.1% setting +50ps.
Delay Duty Factor	> 50% for period > 200ns and reduces to 30% at 100ns period.
Width Duty Factor	> 70% for period > 200ns and reduces to 50% at 100ns period. Front panel warning light indicates either delay or width duty factor is exceeded.
Clock Source Output	2.5V min. from 50 Ω , t_r, t_f < 10ns.
"A" and "B" Outputs	2.5V min. from 50 Ω , t_r, t_f < 10ns, normal or inverted.
Reset (rear) Input*	2V min. or open circuit enables multiplied outputs.

* Option 002 and TM-506-02 power module with Pulse Instruments MOD-451/451A or MOD-454/454A required for digital programming operation and Reset input.

III. FRONT PANEL CONTROL

1. MULTIPLIER Selector Switch	Selects multiplier N from 2 to 999, inclusive. The number N_A or N_B determines the ratio of the clock period in channel A or B to that of the clock source.
2. CLOCK SOURCE	Selects internal variable oscillator (INT CLOCK), 60Hz AC source (LINE) or internal 10MHz crystal reference (XTAL REF, option 001 only).
3. PERIOD Range Selector Switch	Selects range of internal clock period, 50ns, 500ns or 5us.
4. Continuous PERIOD Control/EXT CLOCK IN Selector Switch	Provides greater than 10 to 1 INT CLOCK period variation in any given range setting. Selects External Clock input when pull-switch is activated.

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5. OUTPUT MODE Selector Switch	Selects one of the three modes of operation. NORMAL - Clock source output continuous. Channels A and B multiplied by N_A and N_B. BURST - Clock source output in burst mode. N_A determines the exact number of clock pulses in burst, and N_B determines the number of clock periods in a burst cycle. Channel A output is a negative going gate, with delay and width controls inoperative. Channel B output is in NORMAL mode.
A X B	Period of Channel B output equals $N_A \times N_B$ times that of clock source, $4 \leqslant N_A \times N_B \leqslant 998,001$. Clock source and Channel A outputs as in NORMAL mode.
6. BURST MODE	Selects single cycle burst or continuous burst. 10MHz clock rate maximum.
7. CLOCK/BURST Output	Continuous or burst clock output, 2.5V min. from 50 Ω source, suitable for driving TTL circuits at the end of a length of 50 ohm cable. $V_{OL} \leqslant 0.25V$.
8. EXT. CLOCK IN	TTL compatible, 2V, 25ns min. pulse width required, single pulse to 20MHz.
9. DELAY/WIDTH Range Selector Switches	Select range of output delay with respect to clock source output and range of output pulse width, respectively, 50ns, 500ns or 5us. Delay/width switches inoperative for channel A in burst mode.
10. Continuous DELAY Control	Provides greater than 10 to 1 delay variation in any given range setting. Delay control inoperative for channel A in burst mode.
11. Continuous WIDTH Control/Invert Switch	Provides greater than 10 to 1 width variation in any given range setting. Inverts output

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	polarity when INVERT-pull switch is activated.
12. LOAD N/PROGRAM N* CH A/CH B	Depressing switch in the downward direction loads multiplier N into channel A. Switch set in the up position enables digital programming of multiplier N in units with option 002. TM-506-02 power module with Pulse Instruments MOD-451 or 451A required for digital programming.
13. CHANNEL A/GATE OUTPUT	Multiplied output in normal mode and gate output in burst mode. 2.5V min. from 50Ω source, suitable for driving TTL circuits at the end of a length of 50 ohm cable. $V_{OL} \leq 0.25V$.
14. REDUCE DLY/PW	Indicates delay and/or pulse width duty factor is exceeded. Reducing either delay or pulse width control setting or both turns warning light off. Warning light also might turn on when power is first applied; it can be turned off by loading in values of N in both channels.
15. LOAD N*	Depressing switch in the downward direction loads N into channel B. Manual loading inoperative in digitally programming mode.
16. Channel B/AXB Output	Clock source period multiplied by N_B in normal or burst mode; period multiplied by $N_A \times N_B$ in A x B mode.
17. POWER	Indicates power is on.

* "N" must be loaded at clock rates ≤10MHz.

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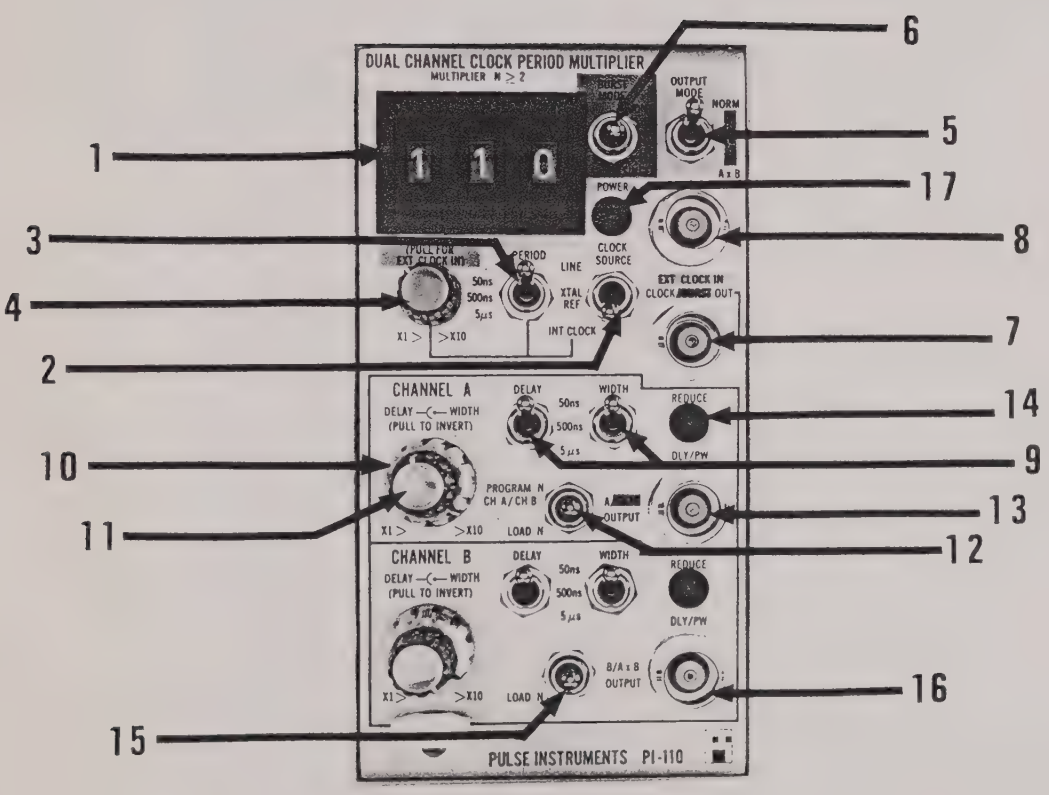
DUAL CHANNEL CLOCK PERIOD MULTIPLIER
MULTIPLIER N ≥ 2
1 1 0
BURST MODE
OUTPUT MODE
NORM
A x B
POWER
(PULL FOR EXT CLOCK IN)
PERIOD
50ns
500ns
5µs
X1
X10
LINE
XTAL REF
INT CLOCK
CLOCK SOURCE
EXT CLOCK IN
CLOCK BURST OUT
CHANNEL A
DELAY ←(→ WIDTH
(PULL TO INVERT)
DELAY
WIDTH
REDUCE
DLY/PW
PROGRAM N
CH A/CH B
LOAD N
A OUTPUT
CHANNEL B
B/A x B OUTPUT
PULSE INSTRUMENTS PI-110
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IV. REAR ENABLE INPUT

An Enable Input is provided which can be accessed through the "TTL CLOCK INPUT" BNC connector mounted on the rear panel of the TM-506 power module, equipped with Pulse Instruments MOD-DP (also the earlier MOD-451, MOD-451A, MOD-454 and MOD-454A) wiring.

When the TTL compatible Enable Input is driven low, all internal counting circuits are inhibited and resetted, and the multiplied outputs are disabled. When the Enable Input is high, normal operation resumes. Consequently, the Enable Input can also be used for synchronizing PI-110's with other instruments.

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